The accuracy is:

Scegli un'alternativa:

- a. The number of correct significant digits in approximating some quantity.
- b. The number of digits with which a number is expressed.
- c. None of the above.

Given two random variables X and Y, Bayes Theorem implies that $p(y|x) = \frac{p(x|y)p(y)}{p(x)}$ where:

Scegli un'alternativa:

- a. $p(x|y)$ is called prior distribution on x.
- b. $p(x|y)$ is called posterior distribution on y.
- c. $p(x|y)$ is called likelihood on y.

Given two random variables X and Y, Bayes Theorem implies that $p(y|x) = \frac{p(x|y)p(y)}{p(x)}$ where:

Scegli un'alternativa:

- a. $p(y|x)$ is called prior distribution on x.
- b. $p(y|x)$ is called likelihood on y.
- c. $p(y|x)$ is called posterior distribution on y.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1 e^{x_2}$, $g : \mathbb{R} \to \mathbb{R}^2$, $g(t) = (e^t, t)$, then, if $h(t) = f(g(t))$:

Scegli un'alternativa:

- a. $h'(t) = te^t$.
- b. $h'(t) = 2e^{2t}$.
- c. $h'(t) = e^{2t}(t+1)$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1^2 + x_1 x_2$, $g : \mathbb{R} \to \mathbb{R}^2$, $g(t) = (\sin(t), \cos(t))$, then, if $h(t) = f(g(t))$:

Scegli un'alternativa:

- a. $h'(t) = \sin(2t) - \sin^2(t)$.
- b. $h'(t) = \sin(t) - \sin^2(2t)$.
- c. $h'(t) = \sin(t)\cos(t) - \sin^2(t)$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1^2 + x_2^2$, $g : \mathbb{R}^2 \to \mathbb{R}^2$, $g(x_1, x_2) = (x_2, x_1)$, then, if $h(x_1, x_2) = f(g(x_1, x_2))$:

Scegli un'alternativa:

- a. $\nabla h(x_1, x_2) = (2x_1, 2x_2)$.
- b. $\nabla h(x_1, x_2) = (2x_2, 2x_1)$.
- c. $\nabla h(x_1, x_2) = (1, 1)$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1 e^{x_2}$, $g : \mathbb{R} \to \mathbb{R}^2$, $g(t) = (t, \log t)$, then, if $h(t) = f(g(t))$:

Scegli un'alternativa:

- a. $h'(t) = t + 1.$
- b. $h'(t) = t^2 + 1.$
- c. $h'(t) = 2t.$

If $f:\mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1^2 + x_1 x_2$, $g:\mathbb{R} \to \mathbb{R}^2$, $g(t) = (t^2, t)$, then, if $h(t) = f(g(t))$:

Scegli un'alternativa:

- a. $h'(t) = t(2t-1)^2 + t.$
- b. $h'(t) = 4t^2 + 2t + 1.$
- c. $h'(t) = t(2t+1)^2 - 2t^2.$

If $f:\mathbb{R}^2\to\mathbb{R}$, $f(x_1,x_2)=x_1^2+x_2^2$, $g:\mathbb{R}^2\to\mathbb{R}^2$, $g(x_1,x_2)=(x_1e^{x_2},x_2)$, then, if $h(x_1,x_2)=f(g(x_1,x_2))$:

Scegli un'alternativa:

- a. $\nabla h(x_1,x_2)=(2x_1e^{x_2}(e^{x_2}+x_1),2e^{x_2})$.
- b. $\nabla h(x_1,x_2)=(2x_1e^{2x_2}(e^{x_1}+x_1),2x_2)$.
- c. $\nabla h(x_1,x_2)=(2x_1e^{x_2}(e^{x_2}+x_1),2x_2)$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1 x_2$, $g : \mathbb{R} \to \mathbb{R}^2$, $g(t) = (t, t^2)$, then, if $h(t) = f(g(t))$:

Scegli un'alternativa:

- a. $h'(t) = 3t^2$.
- b. $h'(t) = 3t^3$.
- c. $h'(t) = t^2$.

If

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. $K_2(A) = 1.$
- b. $K_2(A) = 4.$
- c. $K_2(A) = \frac{1}{2}.$

If

$$A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. $K_2(A) = 4.$
- b. $K_2(A) = 2.$
- c. $K_2(A) = \frac{4}{3}.$

If vector $v = (10^6, 0)^T$ is approximated by vector $\tilde{v} = (999996, 1)^T$, then in $|| \cdot ||_2$ the relative error between v and $\tilde{v}$ is:

Scegli un'alternativa:

- a. $\sqrt{17} \cdot 10^{-6}$.
- b. None of the above.
- c. $4 \cdot 10^{-6}$.

If

$$A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. $K_2(A) = \frac{1}{2}$.
- b. $K_2(A) = 4$.
- c. $K_2(A) = 2$.

A random variable $X : \Omega \to \mathcal{T}$ is continuous when:

Scegli un'alternativa:

- a. $\mathcal{T}$ is countable.
- b. $\mathcal{T} = \mathbb{R}$.
- c. Ω is continuous.

A random variable $X : \Omega \to \mathcal{T}$ is discrete when:

Scegli un'alternativa:

- a. $\mathcal{T} = \mathbb{R}$.
- b. Ω is countable.
- c. $\mathcal{T}$ is countable.

If

$$A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $x = (1, 2)^T$ is an eigenvector of A.
- b. $x = (2, 1)^T$ is an eigenvector of A.
- c. $x = (0, 0)^T$ is an eigenvector of A.

If

$$A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $\lambda = 5$ is the eigenvalue associated with the eigenvector $x = (2, 1)^T$.
- b. $\lambda = 2$ is the eigenvalue associated with the eigenvector $x = (2, 1)^T$.
- c. $\lambda = 2$ is the eigenvalue associated with the eigenvector $x = (1, 2)^T$.

If

$$A = \begin{bmatrix} 4 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $x = (1, 1, 0)^T$ is an eigenvector of A.
- b. $x = (0, 1, 0)^T$ is an eigenvector of A.
- c. $x = (0, -1, 1)^T$ is an eigenvector of A.

If

$$A = \begin{bmatrix} 4 & 0 \\ 0 & 2 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $x = (0,0)^T$ is an eigenvector of A.
- b. $x = (1,0)^T$ is an eigenvector of A.
- c. $x = (1,1)^T$ is an eigenvector of A.

If

$$A = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $\lambda = 2$ is the eigenvalue associated with the eigenvector $x = (1, 0)^T$.
- b. $\lambda = 2$ is the eigenvalue associated with the eigenvector $x = (0, 1)^T$.
- c. $\lambda = 1$ is the eigenvalue associated with the eigenvector $x = (1, 0)^T$.

If $A \in \mathbb{R}^{n \times n}, x \in \mathbb{R}^n$ and

$$Ax = \lambda x$$

For $\lambda \in \mathbb{R}$, then:

Scegli un'alternativa:

- a. For any $c \in \mathbb{R}$, $c \neq 0$, cx is an eigenvector of A.
- b. cx is an eigenvector of A if and only if $c = 1$.
- c. None of the above.

If

$$A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $\lambda = 2$ is the eigenvalue associated with the eigenvector $x = (0,1,0)^T$.
- b. $\lambda = -1$ is the eigenvalue associated with the eigenvector $x = (0,0,1)^T$.
- c. $\lambda = 1$ is the eigenvalue associated with the eigenvector $x = (1,0,0)^T$.

In $\mathcal{F}(10, 2, -2, 2)$, if $x = \pi$, $y = e$, and $z = fl(x) - fl(y)$, then:

Scegli un'alternativa:

- a. $fl(z) = 0.43 \times 10^1$.
- b. $fl(z) = 0.44 \times 10^1$.
- c. $fl(z) = 0.40 \times 10^1$.

In $\mathcal{F}(10, 2, -2, 2)$, if $x = \pi$, $y = e$, and $z = fl(x) * fl(y)$, then:

Scegli un'alternativa:

- a. $fl(z) = 0.84 \times 10^1$.
- b. $fl(z) = 0.0837 \times 10^2$.
- c. $fl(z) = 0.837 \times 10^1$.

In $\mathcal{F}(10,6,-3,3)$, if $x = 192.403$, $y = 0.635782$, and $z = fl(x) + fl(y)$, then:

Scegli un'alternativa:

- a. $fl(z) = 0.193039 \times 10^3$.
- b. $fl(z) = 0.193038 \times 10^3$.
- c. $fl(z) = 0.193038782 \times 10^3$.

In $\mathcal{F}(10, 2, -2, 2)$, if $x = \pi$, $y = e$, and $z = fl(x) + fl(y)$, then:

Scegli un'alternativa:

- a. $fl(z) = 0.585 \times 10^1$.
- b. $fl(z) = 0.58 \times 10^1$.
- c. $fl(z) = 0.59 \times 10^1$.

If $f : \mathbb{R}^n \to \mathbb{R}$, $f \in \mathcal{C}^1(\mathbb{R}^n)$, then x^* is a minimum point if and only if:

Scegli un'alternativa:

- a. $\nabla f(x^*) = 0$ and $\nabla^2 f(x^*)$ is positive semi-definite.
- b. $\nabla f(x^*) = 0$.
- c. $\nabla f(x^*) = 0$ and $\nabla^2 f(x^*)$ is positive definite.

Gradient descent methods:

Scegli un'alternativa:

- a. If α is suitable chosen, $f \in C^1$, for any x_0, always converges to a stationary point of $f(x)$.
- b. If α is suitable chosen, $f \in C^1$, for any x_0, always converges to a minimum of $f(x)$.
- c. Always converges to a minimum of $f(x)$.

Gradient descent methods solves the optimization problem

$$\min_x f(x)$$

By:

Scegli un'alternativa:

- a. Generating a sequence $\{x_k\}_k$ such that, given x_0, computes $x_{k+1} = x_k - \alpha \nabla f(x_k)$ for $\alpha > 0$ step-size.
- b. Generating a sequence $\{x_k\}_k$ such that, given x_0, computes $x_{k+1} = x_k + \alpha \nabla f(x_k)$ for $\alpha > 0$ step-size.
- c. Generating a sequence $\{x_k\}_k$ such that, given x_0, computes $x_{k+1} = x_k - \alpha \nabla f(x_k)$ for $\alpha \neq 0$ step-size.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1^2 + x_2^2$, then if the initial guess for a gradient descent iteration is $x^{(0)} = (1,1)^T$ and $\alpha > 0$, then $|f(x^{(1)})| < |f(x^{(0)}|$ if:

Scegli un'alternativa:

- a. $0 < \alpha < 1.$
- b. $\alpha > 0.$
- c. $\alpha > \frac{1}{2}.$

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = e^{x_1} + x_2^2$, then if the initial guess for a gradient descent iteration is $x^{(0)} = (0,0)^T$ and $\alpha > 0$, then $|f(x^{(1)})| < |f(x^{(0)}|$ if:

Scegli un'alternativa:

- a. $\alpha > \frac{1}{2}$.
- b. $\alpha > 0$.
- c. $0 < \alpha < 1$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1 e^{x_2}$, then if the initial guess for a gradient descent iteration is $x^{(0)} = (1, 1)^T$ and $\alpha = \frac{1}{2}$, then:

Scegli un'alternativa:

- a. $x^{(1)} = (1 - \frac{e}{2}, 1 - \frac{e}{2})^T$.
- b. $x^{(1)} = (1 + \frac{e}{2}, 1 + \frac{e}{2})^T$.
- c. $x^{(1)} = (\frac{1}{2} - \frac{e}{2}, \frac{1}{2} - \frac{e}{2})^T$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1 e^{x_2}$, then if the initial guess for a gradient descent iteration is $x^{(0)} = (0, 0)^T$ and $\alpha = 1$, then:

Scegli un'alternativa:

- a. $x^{(1)} = (1, 0)^T$.
- b. $x^{(1)} = (-1, 0)^T$.
- c. $x^{(1)} = (0, 0)^T$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = x_1^2 + x_2^2$, then if the initial guess for a gradient descent iteration is $x^{(0)} = (1, 1)^T$ and $\alpha > 0$, then:

Scegli un'alternativa:

- a. $x^{(1)} = (1 - 2\alpha, 1 - 2\alpha)^T$.
- b. $x^{(1)} = (1 - \alpha, 1 - \alpha)^T$.
- c. $x^{(1)} = (1 + 2\alpha, 1 + 2\alpha)^T$.

If $f : \mathbb{R}^2 \to \mathbb{R}$, $f(x_1, x_2) = e^{x_1} + x_2^2$, then if the initial guess for a gradient descent iteration is $x^{(0)} = (0, 0)^T$ and $\alpha > 0$, then:

Scegli un'alternativa:

- a. $x^{(1)} = (-\alpha, 0)^T$.
- b. $x^{(1)} = (0, 0)^T$.
- c. $x^{(1)} = (-\alpha, 2)^T$.

For Standard IEEE, double precision representation is:

Scegli un'alternativa:

- a. $\mathcal{F}(2, 64, -1024, 1023)$.
- b. None of the above.
- c. $\mathcal{F}(2, 53, -1024, 1023)$.

For Standard IEEE, single precision representation is:

Scegli un'alternativa:

- a. $\mathcal{F}(2, 24, -128, 127)$.
- b. None of the above.
- c. $\mathcal{F}(2, 32, -128, 127)$.

Given two independent random variables X and Y, then:

Scegli un'alternativa:

- a. p(x) = p(y)
- b. p(y) = p(y|x)
- c. p(x|y) = p(y)

Given two random variables X and Y, Bayes Theorem implies that:

Scegli un'alternativa:

- a. p(x) = p(y)p(y|x) / p(y|x).
- b. p(x) = p(x|y)p(y|x) / p(y).
- c. p(y) = p(y|x)p(x) / p(x|y).

If $f : \mathbb{R}^n \to \mathbb{R}$, $f(x) = ||Ax - b||_2^2$ for $A \in \mathbb{R}^{m \times n}, b \in \mathbb{R}^m$, then:

Scegli un'alternativa:

- a. $\nabla f(x) = 2A^T(Ax - b)$.
- b. $\nabla f(x) = A^T(Ax - b)$.
- c. $\nabla f(x) = A(A^T x - b)$.

If $f : \mathbb{R}^n \to \mathbb{R}, f(x) = ||Ax - b||_2^2$ for $A \in \mathbb{R}^{m \times n}, b \in \mathbb{R}^m$, then the solution of $\nabla f(x) = 0$ is:

Scegli un'alternativa:

- a. $A^T Ax = b$
- b. $A^T Ax = A^T x$
- c. $Ax = b.$

The machine precision ϵ can be defined as:

Select one:

- a. The smallest number ϵ such that $fl(1+\epsilon)=1$.
- b. The smallest number ϵ such that $fl(1+\epsilon)>1$.
- c. None of the above.

Given two random variables X and Y such that $p(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x}$ and $p(y|x) = ce^{-|y-ax|}$, then the MAP reads:

Scegli un'alternativa:

- a. $x^* = \arg\min_x |y - ax| + \frac{1}{2}x^2$.
- b. $x^* = \arg\min_x |y - ax|$.
- c. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2$.

Given two random variables X and Y such that $p(x) = ce^{-|x|}$ and $p(y|x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(y-ax)^2}$, then the MAP reads:

Scegli un'alternativa:

- a. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + |x|.$
- b. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + \frac{1}{2}x^2.$
- c. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2.$

Given two random variables X and Y such that $p(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2}$ and $p(y|x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(y-ax)^2}$, then the MAP reads:

Scegli un'alternativa:

- a. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + \frac{1}{2}x^2.$
- b. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + x^2.$
- c. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2.$

If

$$A = \begin{bmatrix} 2 & 1 & -2 \\ -1 & 0 & 1 \\ -1 & 2 & 1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is orthogonal.
- b. None of the above.
- c. A is symmetric and definite positive.

If

$$A = \begin{bmatrix} 2 & 0 \\ 0 & 1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is symmetric and positive definite.
- b. A is non-symmetric and not positive definite.
- c. A is symmetric but not positive definite.

If

$$A = \begin{bmatrix} \frac{2}{3} & \frac{1}{3} & \frac{2}{3} \\ -\frac{2}{3} & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{2}{3} & -\frac{2}{3} \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is symmetric and definite positive.
- b. A is symmetric but not definite positive.
- c. A is orthogonal.

If

$$A = \begin{bmatrix} 2 & 2 & -1 \\ 2 & 0 & 2 \\ -1 & 2 & 3 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is symmetric but not definite positive.
- b. A is symmetric and definite positive.
- c. A is orthogonal.

If

$$A = \begin{bmatrix} -1 & 1 \\ 0 & 3 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is symmetric but not positive definite.
- b. A is symmetric and positive definite.
- c. A is non-symmetric and not positive definite.

If

$$A = \begin{bmatrix} 9 & 6 \\ 6 & 5 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is symmetric but not positive definite.
- b. A is non-symmetric and not positive definite.
- c. A is symmetric and positive definite.

If

$$A = \begin{bmatrix} -1 & 0 \\ 0 & 3 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is symmetric and positive definite.
- b. A is symmetric but not positive definite.
- c. A is non-symmetric and not positive definite.

If

$$A = \begin{bmatrix} 2 & 1 & 2 \\ -2 & 2 & 1 \\ 1 & 2 & -2 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. A is not orthogonal.
- b. A is orthogonal.
- c. A is symmetric but not definite positive.

If

$$A = \begin{bmatrix} 1 & 0 & 3 \\ 1 & 1 & 0 \\ -1 & 1 & 2 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $rank(A) = 2.$
- b. $rank(A) = 1.$
- c. $rank(A) = 3.$

If

$$A = \begin{bmatrix} 0 & 6 & 8 \\ 2 & 4 & 0 \\ 1 & 0 & 8 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $rank(A) = 3.$
- b. $rank(A) = 2.$
- c. $rank(A) = 1.$

If

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $rank(A) = 2.$
- b. $rank(A) = 1.$
- c. $rank(A) = 3.$

If

$$A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. $rank(A) = 3.$
- b. $rank(A) = 4.$
- c. $rank(A) = 2.$

If

$$A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -2 & 2 \\ -1 & 1 & -1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $rank(A) = 3.$
- b. $rank(A) = 1.$
- c. $rank(A) = 2.$

If

$$A = \begin{bmatrix} 0 & 2 & -1 \\ 1 & 1 & 0 \\ 1 & 3 & -1 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $rank(A) = 2.$
- b. $rank(A) = 3.$
- c. $rank(A) = 1.$

If

$$A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. $rank(A) = 4.$
- b. $rank(A) = 2.$
- c. $rank(A) = 3.$

If

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 2 & 1 & 2 \end{bmatrix}$$

Then:

Scegli un'alternativa:

- a. $rank(A) = 1.$
- b. $rank(A) = 3.$
- c. $rank(A) = 2.$

Given two random variables X and Y such that $p(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x}$ and $p(y|x) = ce^{-|y-ax|}$, then the MLE reads:

Scegli un'alternativa:

- a. $x^* = \arg\min_x |y - ax| + x^2$.
- b. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2$.
- c. $x^* = \arg\min_x |y - ax|$.

Given two random variables X and Y such that $p(x) = ce^{-|x|}$ and $p(y|x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(y-ax)^2}$, then the MLE reads:

Scegli un'alternativa:

- a. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + |x|$.
- b. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + \frac{1}{2}x^2$.
- c. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2$.

Given two random variables X and Y such that $p(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x}$ and $p(y|x) = ce^{-|y-ax|}$, then the MLE reads:

Scegli un'alternativa:

- a. $x^* = \arg\min_x |y - ax| + x^2.$
- b. $x^* = \arg\min_x |y - ax|.$
- c. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2.$

Given two random variables X and Y such that $p(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2}$ and $p(y|x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(y-ax)^2}$, then the MLE reads:

Scegli un'alternativa:

- a. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + \frac{1}{2}x^2.$
- b. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2 + x^2.$
- c. $x^* = \arg\min_x \frac{1}{2}(y - ax)^2.$

If

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. The 2-norm of A is $||A||_2 = 1$.
- b. The 2-norm of A is $||A||_2 = 0$.
- c. The 2-norm of A is $||A||_2 = 3$.

If

$$A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 4 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. The 2-norm of A is $||A||_2 = 2.$
- b. The 2-norm of A is $||A||_2 = 4.$
- c. The 2-norm of A is $||A||_2 = 2.$

If

$$A = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

then:

Scegli un'alternativa:

- a. The 2-norm of A is $||A||_2 = 3$.
- b. The 2-norm of A is $||A||_2 = 0$.
- c. The 2-norm of A is $||A||_2 = 3$.

If A is an $n \times n$ matrix, then

Scegli un'alternativa:

- a. $||A||_1 = \sqrt{\sum_{i=1}^{n} \sum_{j=1}^{n} a_{i,j}^2}$.
- b. $||A||_1 = \rho(A^T A)$.
- c. None of the above.

If A is an $n \times n$ matrix, then

Scegli un'alternativa:

- a. None of the above.
- b. $||A||_2 = \rho(A^T A)$.
- c. $||A||_2 = \sqrt{\sum_{i=1}^{n} \sum_{j=1}^{n} a_{i,j}^2}$.

If A is an $n \times n$ matrix, then

Scegli un'alternativa:

- a. $||A||_F = \sqrt{\sum_{i=1}^{n} \sum_{j=1}^{n} a_{i,j}^2}$.
- b. None of the above.
- c. $||A||_F = \rho(A^T A)$.

If $A \in \mathbb{R}^{m \times n}$, $||A||_p = \mathbf{0}$, then:

Scegli un'alternativa:

- a. $A = 0$.
- b. $rank(A) = 0$.
- c. A can be both equal or not equal to 0.

A matrix $A \in \mathbb{R}^{n \times n}$ is orthogonal if:

Scegli un'alternativa:

- a. $A^{-1}A = I = AA^{-1}$.
- b. $A^{T}A = I = AA^{T}$.
- c. $A = A^{T}$.

If $X : \Omega \to \mathcal{T}$ is a continuous random variable, then a function $p : \mathcal{T} \to \mathbb{R}_+$ can be the PDF of X if:

Scegli un'alternativa:

- a. $\int_{\mathcal{T}} p(x)dx = 1.$
- b. $\int_{\Omega} p(x)dx = 1.$
- c. $\int_{\mathcal{T}} p(x)dx < \infty.$

For a random variable $X : \Omega \to \mathcal{T}$ with $\mathbb{E}[X] = 0$, it holds:

Scegli un'alternativa:

- a. $Var(X) = \mathbb{E}[X]$.
- b. $Var(X) = \mathbb{E}[X^2]$.
- c. $Var(X) = 0$.

If $X : \Omega \to \mathcal{T}$ is a discrete random variable, then a function $f_X : \mathcal{T} \to [0, 1]$ can be the PDF of X if:

Scegli un'alternativa:

- a. $\sum_{i \in \Omega} f_X(i) = 1.$
- b. $\int_\Omega f_X(x)dx = 1.$
- c. $\sum_{i \in \mathcal{T}} f_X(i) = 1.$

Given a discrete random variable $X : \Omega \to \mathcal{T}$, with $\mathcal{T} = \{1, 2, \ldots, 6\}$, and $f_X = \{\frac{1}{6}, \frac{1}{6}, \ldots, \frac{1}{6}\}$, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X] = 21.$
- b. $\mathbb{E}[X] = 3.5.$
- c. $\mathbb{E}[X] = \frac{1}{6}.$

Given a continuous random variable $X : \Omega \to \mathcal{T}$, with $\mathcal{T} = [0, 1]$, and $p(x) = 3x^2$ its PDF, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X] = 2.$
- b. $\mathbb{E}[X] = 3.$
- c. $\mathbb{E}[X] = \frac{3}{4}.$

Given a continuous random variable $X : \Omega \to \mathcal{T}$, with $\mathcal{T} = [0, 1]$, and $p(x) = 2x$ its PDF, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X] = \frac{2}{3}$.
- b. $\mathbb{E}[X] = 2$.
- c. $\mathbb{E}[X] = 1$.

If $X : \Omega \to \mathcal{T}$ is a continuous random variable with PDG $p : \mathcal{T} \to \mathbb{R}_+$, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X] = \int_{\mathcal{T}} p(x)dx$.
- b. $\mathbb{E}[X] = \int_{\Omega} xp(x)dx$.
- c. $\mathbb{E}[X] = \int_{\mathcal{T}} xp(x)dx$.

If $X : \Omega \to \mathcal{T}$ is a continuous random variable, its Probability Density Function (PDF) $p_X(x)$ is defined to be:

Scegli un'alternativa:

- a. $P(X = x) = p_X(x)$.
- b. $P(X = x) = \int x p_X(x) dx$.
- c. $P(X \in A) = \int_A p_X(x) dx$.

If $X : \Omega \rightarrow \mathcal{T}$ is a continuous random variable, its Probability Density Function (PDF) $p_X(x)$ is:

Scegli un'alternativa:

- a. A function $p_X : \mathcal{T} \rightarrow \mathbb{R}_+$.
- b. A function $p_X : \mathcal{T} \rightarrow [0, 1]$.
- c. A function $p_X : \Omega \rightarrow [0, 1]$.

If $X : \Omega \to \mathcal{T}$ is a discrete random variable, its Probability Mass Function (PMF) f_x is:

Select one:

- a. A function $f_X : \mathcal{T} \to [0, 1]$.
- b. A function $f_X : \Omega \to [0, 1]$.
- c. A function $f_X : \mathcal{T} \to \mathbb{R}$.

Given two discrete random variable $X_1 : \Omega \to \mathcal{T}$, $X_2 : \Omega \to \mathcal{T}$ with $\mathcal{T} = \{1, 2, 3\}$, and $f_{X_1} = \{\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\}$, $f_{X_2} = \{\frac{1}{2}, \frac{1}{6}, \frac{1}{3}\}$ their PMF, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X_1] < \mathbb{E}[X_2]$.
- b. $\mathbb{E}[X_1] = \mathbb{E}[X_2]$.
- c. $\mathbb{E}[X_1] > \mathbb{E}[X_2]$.

If $X : \Omega \to \mathcal{T}$ is a discrete random variable, its Probability Mass Function (PMF) f_x is:

Scegli un'alternativa:

- a. $f_X(x) = \int P(x)dx.$
- b. $f_X(x) = P(X \in x).$
- c. $f_X(x) = P(X = x).$

If $X : \Omega \to \mathcal{T}$ is a discrete random variable with PMG $f_X : \mathcal{T} \to [0, 1]$, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X] = \sum_{i \in \mathcal{T}} i.$
- b. $\mathbb{E}[X] = \sum_{i \in \mathcal{T}} i f_X(i).$

◄ Exam subscription November 2

Vai a...

Given a discrete random variable $X : \Omega \to \mathcal{T}$, with $\mathcal{T} = \{1, 2, 3\}$, and $f_X = \{\frac{1}{2}, \frac{1}{6}, \frac{1}{3}\}$ its PMF, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X] = 6.$
- b. $\mathbb{E}[X] = 2.$
- c. $\mathbb{E}[X] = \frac{11}{6}.$

Given a discrete random variable $X : \Omega \to \mathcal{T}$, with $\mathcal{T} = \{1, 2, 3\}$, and $f_X = \{\frac{1}{6}, \frac{1}{3}, \frac{1}{2}\}$ its PMF, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X] = 6.$
- b. $\mathbb{E}[X] = 2.$
- c. $\mathbb{E}[X] = \frac{13}{6}.$

Given two discrete random variable $X_1 : \Omega \to \mathcal{T}$, $X_2 : \Omega \to \mathcal{T}$ with $\mathcal{T} = \{1, 2, 3\}$, and $f_{X_1} = \{\frac{1}{3}, \frac{1}{3}, \frac{1}{3}\}$, $f_{X_2} = \{\frac{1}{2}, \frac{1}{6}, \frac{1}{3}\}$ their PMF, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X_1] < \mathbb{E}[X_2]$.
- b. $\mathbb{E}[X_1] = \mathbb{E}[X_2]$.
- c. $\mathbb{E}[X_1] > \mathbb{E}[X_2]$.

Given two discrete random variable $X_1 : \Omega \to \mathcal{T}$, $X_2 : \Omega \to \mathcal{T}$ with $\mathcal{T} = \{1, 2, 3\}$, and $f_{X_1} = \{\frac{1}{2}, \frac{1}{6}, \frac{1}{3}\}$, $f_{X_2} = \{\frac{1}{6}, \frac{1}{3}, \frac{1}{2}\}$ their PMF, then:

Scegli un'alternativa:

- a. $\mathbb{E}[X_1] > \mathbb{E}[X_2]$.
- b. $\mathbb{E}[X_1] = \mathbb{E}[X_2]$.
- c. $\mathbb{E}[X_1] < \mathbb{E}[X_2]$.

The precision is:

Scegli un'alternativa:

- a. None of the above.
- b. The number of digits with which a number is expressed.
- c. The number of correct significant digits in approximating some quantity.

A random variable X is:

Scegli un'alternativa:

- a. A function $X : \Omega \to \mathcal{T}$.
- b. A variable that returns random elements with known probability.
- c. A set that contains the possible outcomes of the experiment.

If Ω is the sample space, $\mathcal{A}$ is the event space and $\mathcal{T}$ is a subset of $\mathbb{R}$, a random variable X is:

Scegli un'alternativa:

- a. A function $X : \Omega \to \mathcal{A}$.
- b. A function $X : \mathcal{A} \to \mathcal{T}$.
- c. A function $X : \Omega \to \mathcal{T}$.

In normalized scientific notation and base $\beta = 10$, if $x = 2.71$, then:

Scegli un'alternativa:

- a. The mantissa of x is 0.271 and the exponential part is 10^1.
- b. The mantissa of x is 2.71 and the exponential part is 10^0.
- c. None of the above.

If $A = U\Sigma V^T$ is the SVD decomposition of $A \in \mathbb{R}^{m\times n}$, then a dyade $A_i = u_i v_i^T$ of A is:

Scegli un'alternativa:

- a. None of the above.
- b. A vector of length mn that express some properties of A.
- c. A rank-1 matrix of dimension $m \times n$.

If $A = U\Sigma V^T$ is the SVD decomposition of an $m \times n$ matrix A, then:

Scegli un'alternativa:

- a. $A^T A = V^T \Sigma^2 V$.
- b. $A^T A = U \Sigma^2 U^T$.
- c. $A^T A = V \Sigma^2 V^T$.

If $A = U\Sigma V^T$ is the SVD decomposition of an $m \times n$ matrix A, then:

Scegli un'alternativa:

- a. The rows of V^T are eigenvectors of AA^T.
- b. The columns of U are eigenvectors of AA^T.
- c. None of the above

If $A = U\Sigma V^T$ is the SVD decomposition of an $m \times n$ matrix A, then:

Scegli un'alternativa:

- a. The rows of V^T are eigenvectors of $A^T A$.
- b. None of the above
- c. The columns of U are eigenvectors of $A^T A$.

Given a matrix $A \in \mathbb{R}^{m\times n}$, $m > n$, with $r = rank(A)$, then:

Scegli un'alternativa:

- a. None of the above.
- b. It is always possible to write A as $U\Sigma V^T$, where $\Sigma \in \mathbb{R}^{m\times n}$ is diagonal, $U \in \mathbb{R}^{m\times m}$, $V \in \mathbb{R}^{n\times n}$ are orthogonals.
- c. It is possible to write A as $U\Sigma V^T$, where $\Sigma \in \mathbb{R}^{m\times n}$ is diagonal, $U \in \mathbb{R}^{m\times m}$, $V \in \mathbb{R}^{n\times n}$ are orthogonals if and only if $rank(A) = n$.

If $A = U\Sigma V^T$ is the SVD decomposition of an $m \times n$ matrix A, then:

Scegli un'alternativa:

- a. $AA^T = U^T\Sigma^2U.$
- b. $AA^T = U\Sigma^2U^T.$
- c. $AA^T = U\Sigma U^T.$

If $A = U\Sigma V^T$ is the SVD decomposition of an $m \times n$ matrix A, then:

Scegli un'alternativa:

- a. The elements of the diagonal matrix Σ are the singular values of A, in decreasing order.
- b. The elements of the diagonal matrix Σ are the eigenvalues of A, in decreasing order.
- c. None of the above.

If $A = U\Sigma V^T$ is the SVD decomposition of an $m \times n$ matrix A, then:

Scegli un'alternativa:

- a. The singular values σ_i of A are $\sigma_i = \sqrt{\lambda_i(A^T A)}$ where $\lambda_i(A^T A)$ are the eigenvalues of $A^T A$.
- b. None of the above
- c. The singular values σ_i of A are $\sigma_i = \lambda_i(A^T A)$ where $\lambda_i(A^T A)$ are the eigenvalues of $A^T A$.

If $A = U\Sigma V^T$ is the SVD decomposition of $A \in \mathbb{R}^{m\times n}$, then the rank k approximation of A is:

Scegli un'alternativa:

- a. $\hat{A}(k) = \sum_{i=1}^{n} \sigma_i A_i$, where $A_i = u_i v_i^T$ is a dyade.
- b. $\hat{A}(k) = \sum_{i=1}^{k} A_i$, where $A_i = u_i v_i^T$ is a dyade.
- c. $\hat{A}(k) = \sum_{i=1}^{k} \sigma_i A_i$, where $A_i = u_i v_i^T$ is a dyade.

If $A = U\Sigma V^T$ is the SVD decomposition of an $m \times n$ matrix A, then:

Scegli un'alternativa:

a. The elements on the diagonal of Σ are strictly positive.

b. None of the above.

c. The elements of the diagonal matrix Σ are non-negative.

If $A = U\Sigma V^T$ is the SVD decomposition of $A \in \mathbb{R}^{m\times n}$, then its rank k approximation of $\hat{A}(k)$ satisfies:

Select one:

- a. $\hat{A}(k) = \arg\min_{rk(B)=k} ||A - B||_2.$
- b. $\hat{A}(k) = \arg\min_{rk(B)=k} ||A - B||_F.$
- c. $\hat{A}(k) = \sigma_{k+1}.$

If $A \in \mathbb{R}^{m \times n}$, then:

Scegli un'alternativa:

- a. $A^T A$ is symmetric but not necessarly positive definite.
- b. $A^T A$ is always symmetric and positive definite.
- c. It depends on A.

For a random variable $X : \Omega \to \mathcal{T}$, its variance is defined as:

Scegli un'alternativa:

- a. $Var(X) = \mathbb{E}[X - \mathbb{E}[X]]$.
- b. $Var(X) = \mathbb{E}[(X - \mathbb{E}[X])^2]$.
- c. $Var(X) = \mathbb{E}[X^2 - \mathbb{E}[X]^2]$.

For a random variable $X : \Omega \to \mathcal{T}$, it holds:

Scegli un'alternativa:

- a. $Var(X) = \mathbb{E}[X^2] - \mathbb{E}[X]^2$.
- b. $Var(X) = \mathbb{E}[X^2] + \mathbb{E}[X]^2$.
- c. $Var(X) = \mathbb{E}[X]^2 - \mathbb{E}[X^2]$.

For a random variable $X : \Omega \to \mathcal{T}$ with $\mathbb{E}[X] = 0$, it holds:

Scegli un'alternativa:

- a. $Var(X) = \mathbb{E}[X^2]$.
- b. $Var(X) = 0$.
- c. $Var(X) = \mathbb{E}[X]$.

If vector $v = (10^6, 0)^T$ is approximated by vector $\tilde{v} = (999996, 1)^T$, then in $||\cdot||_1$ the relative error between v and $\tilde{v}$ is:

Scegli un'alternativa:

- a. $4 \cdot 10^{-6}$.
- b. None of the above.
- c. $5 \cdot 10^{-6}$.

If vector $v = (10^6, 0)^T$ is approximated by vector $\tilde{v} = (999996, 1)^T$, then in $||\cdot||_2$ the relative error between v and $\tilde{v}$ is:

Scegli un'alternativa:

- a. $\sqrt{17} \cdot 10^{-6}$.
- b. $4 \cdot 10^{-6}$.
- c. None of the above.

If vector $v = (1, 0)^T$ is approximated by vector $\tilde{v} = (1.1, 0.1)^T$, then in $|| \cdot ||_1$ the relative error between v and $\tilde{v}$ is:

Scegli un'alternativa:

- a. 0.1.
- b. 0.2.
- c. None of the above.

If vector $v = (10^6, 1)^T$ is approximated by vector $\tilde{v} = (999996, 1)^T$, then in $||\cdot||_\infty$ the relative error between v and $\tilde{v}$ is:

Scegli un'alternativa:

- a. 4.
- b. $4 \cdot 10^{-6}$.
- c. None of the above.

Given $x = (1, -1)^T$ and $y = (2, 1)^T$, then:

Scegli un'alternativa:

- a. None of the above.
- b. $x \perp y$.
- c. $x \parallel y$.

Given $x = (1, -1)^T$ and $y = (1, 1)^T$, then:

Scegli un'alternativa:

- a. $x \perp y$.
- b. None of the above.
- c. $x \parallel y$.